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SUBJECT MATTER INDEX OF APPLI- CATIONS FOR PATENTS.

February 21st to March 20th inclusive.

The following Index gives first the class, then the name of the inventor, and No. of the application. In this list (com.) means Invention communicated from abroad. Further information as to the progress of these Patents by Notice to Proceed, Sealing, and Specifying, can be obtained at the Office, 21, Cockspur Street, Charing-cross.

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ALUMINIUM (Salts), Alumina, Alum, &c.—C. F. Claus, 1096.
ANCHORS (Marine), Lowering Anchors, Moorings, &c.—C. Mac, 1226.
ARMOUR Plates, &c.—L. W. Broadwell, 768.
ASBESTOS and Amianthus (Treating)—A. Hollings, 1244.
ASPHALTE, Bitumen, Tar, Pitch, &c.—J. Woodhead, 1210.
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BANDS, Belts, Straps, Chains, and Ropes for Driving Machinery, Belt Shippers, &c.—A. Carney, 1143. C. P. Carpenter, 1404.
BARIUM (Salts of) Baryta.—C. F. Claus, 1096.
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BATHS, Bathing Appliances, Lavatories, &c.—T. Bradford, 1213. T. J. Saunders and W. H. Allen, 1337.
BEARINGS, &c.—J. A. A. Buchholz, 1262. H. H. Lake (com.), 1385.
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BRAIDING Machines, Plaiting Machines, &c.—W. Ashton, 1297.

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CAISSONS, Cofferdams, &c.—J. J. F. Andrews, 1321.

CALENDARS, &c.—G. H. T. Hawley, 1158.

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Pressure of space compels our leaving over till next month the remainder of the list.

INFLUENCE OF TEMPERATURE ON MAGNETISATION.

M. BERSEN has studied the influence of temperature on the magnetisation of iron, steel, nickel, and cobalt. He places the bar to be experimented on in a constant magnetic field, at different temperatures, and compares its magnetic moments. To make this comparison he adopts the method of Gauss. His apparatus consists of a Bunsen battery of from six to ten cells, the current from which, after having passed through a commutator, traverses a retort carbon rheostat, then the coil which serves to produce the magnetic field. A galvanometer placed in a shunt enables this current to be kept constant. In this magnetising coil is placed the bar, which causes a small declination needle, suspended by a thread to the interior of a copper cage, to deviate. The deviations are read by means of a mirror and scale. The magnetising coil, which must be capable of withstanding high temperatures, is composed of a wire wound, without permitting the coils to touch, on a glass core, and covered with plaster. The whole is placed in a copper stove and heated by a gas lamp. The temperature, which is maintained constant as long as possible, is measured by a thermometer thrust into the stove. Some of the results obtained are as follows:—As regards iron, magnetisation is nearly independent of temperature. The total and temporary magnetisations increase up to 260 deg., then they decrease, while the permanent magnetisation diminishes very slightly. With steel, the total magnetisation increases at first, attains a maximum at 260 deg., and then decreases; the permanent magnetisation attains its maximum toward 240 deg. Variations of temperature during the experiment exercise an influence on the magnetisation, which increases under these conditions. If the temperature of a bar magnetised when cold be raised, its magnetisation diminishes; the same occurs if a bar, which has been magnetised when hot, is cooled. If, now, we temper this latter, it retains a greater magnetic moment than if it had been worked at a low temperature. With nickel, the total magnetisation slowly increases up to 240 deg., and after reaching 280 deg., decreases very rapidly, becoming nil at about 330 deg. Nickel magnetised at a low temperature and heated to 320 deg., loses all magnetisation; if, on the other hand, it has been magnetised at 280 deg., and subsequently slowly cooled, its magnetic moment begins at first to increase, then decreases at about the ordinary temperature, but finally remains greater than at the temperature of magnetisation. Cobalt behaves like steel.—*La Revue Industrielle*.

ALKALIES IN SILVER NITRATE.—Fr. Stolba dissolves the sample in a minimum of water, and adds to the clear solution hydro-fluosilicic acid. A turbidity or a precipitate shows the presence of alkalies.—*Zeitschrift für Analytische Chemie*.



Reviews.

DOMESTIC POISONS.

"Domestic Poisons." By WILLIAM THOMSON, F.R.S. Ed., F.C.S. &c. London and Manchester: John Heywood.

THIS forms one of the lectures published in pamphlet form under the authority of the Manchester and Salford Sanitary Association, and which are sold at one penny each. We consider the number before us to be one of the most important of the series, and that the same ought to be sown broadcast over the land. The subject is treated in a truly scientific manner, and yet sufficiently popular to render a great service to that general public for whom it is intended.

We congratulate Mr. Thomson upon the amount of good the publication of his important lecture is calculated to accomplish amongst the people, who in matters of this kind are even yet woefully ignorant.

MECHANICAL STOKING.

IT is of importance that the sanitary condition of towns should have the attention of all thoughtful people, and that those who, by engaging in manufactures, add to the prosperity of the community, should at the same time use means and adopt improvements in their methods of manufacture, as such are proved to be useful, for preventing their works from becoming injurious to the health and comfort of the general public.

Of late years much attention has been given to measures relating to river pollution, noxious vapours, and smoke consumption, each of which has been brought under the operation of Acts of Parliament. The General Health Act, of 1875, enacts that penalties be enforced against persons committing a nuisance by the emission of smoke from a furnace, but it also very properly provides that the "court shall hold that no nuisance is created within the meaning of the Act, if it is satisfied that such fire-place or furnace is constructed so as to consume as far as practicable, with due regard to the manufacture or trade, all smoke arising therefrom, and that such fire-place or furnace has been carefully attended to by the person in charge thereof."

This is a judicious clause, for the prevention of smoke under some circumstances is a problem that has not yet been thoroughly solved, nor is it wise by too much interference to hamper our manufacturers, who are already heavily handicapped in their endeavours to secure a share of trade in the markets of the world.

In manufacturing districts where the chief source of power is derived from the consumption of coal, and where coal is used for other purposes besides the generation of steam, we may expect a certain amount of impurity in the atmosphere, which, if not absolutely injurious to health, is at least unpleasant to the eye; and although we have done much and may do more to lessen this nuisance, it will be useless to expect that in our manufacturing towns we shall ever have an atmosphere such as is met with in Switzerland or Italy. We are subject to different climatic influences, and our domestic and manufacturing wants will, until some other means of producing heat and motion is obtained, always necessitate smoke to some extent, but there is no doubt that this nuisance may in most instances be considerably reduced.

In reviewing the history of mechanical stoking, we meet with some curious contrivances, and what appears in the present day very primitive notions, and suggestions many of them, fortunately for coal consumers, never carried into effect. In turning to the file of the old *Mechanics' Magazine* we find published over fifty years ago, notices of some inventions for this purpose which

were patented. There was one called Brunton's, and in describing it the inventor is about on a par with many who have written on the subject in much later days. He says:—"I put the coal upon the grate by small quantities and at very short intervals, say every two or three seconds; secondly, I so dispose of the coal upon the grate that the smoke evolved must pass over that part upon which the coal is in full combustion, and is thereby consumed; thirdly, as the introduction of the coal is uniform, in short spaces of time, the introduction of the air is also uniform." For this purpose he used a horizontal circular grate fixed on the top of a vertical spindle and turned by a water-wheel. Several other singular specimens of the talent of that day are to be met with in that old magazine.

One gentleman writing from Manchester recommends that a large flue should be constructed beneath the streets, the furnaces connected to it, and the flue carried to an outlet outside the town. From the way in which Manchester has extended its boundaries since that time, the outlet would have been oftentimes removed; nevertheless this is quite as sensible an idea for curing the nuisance as many that have been suggested since.

A really intelligent and careful fireman can, if he work the boilers slowly and not push the fires, so manage the putting on of coal as to make but little smoke. By moving the red fire to the further part of the bars and putting the fresh fuel on to the front thereof, it can be so arranged that the smoke arising from the fresh coal will be burned in its passage over the red-hot fire at the back part of the bars. It will be seen, however that a boiler so worked cannot be pushed, for the fireman must only put on coal at suitable times, and only use the poker when there is no fresh fuel giving off smoke on the bars. In establishments where the capital required for extra boiler capacity is not of moment, and when the amount of steam power required is so regular that fires need never be pushed, with a careful fireman a quality of fuel that requires little stirring, the chimneys may be kept fairly free from smoke.

This method entails some loss compared with ordinary hand-firing; for though not much fuel is wasted, yet a good deal of cold air is admitted during the moving back of the red fuel. To obviate this, and also to effect the consumption of smoke in boilers, which are hard-worked, and which use cheaper coal, various mechanical contrivances have been suggested, and to these the name of mechanical stokers has been applied.

It would be useless to attempt to notice the numerous methods which have been tried to effect a perfect combustion of fuel by hand firing. During the last fifty years scores of patents have been taken for special shapes, constructions, and peculiar adaptations of fire-bars, and for arrangements of flues, bridge walls, dead plates, and other portions of the furnaces, and many novel and peculiar contrivances for heating air by its passage through hollow fire-bars or flues, and allowing the heated air to rush in at the back or over the top of the fire; but in such arrangements the prevention of smoke effected has chiefly been gained at the expense of a large quantity of coal, and this mostly accounts for their general discontinuance.

Several patents have been obtained for water bars, and, were it not for the difficulties attending these contrivances, through the bars having to withstand heavy pressure, and the uncertainty of assuring a free circulation in consequence of the filling up of the hollow space of the bars by sediment or incrustation, it is possible that bars of this kind would have come into general use, for with bars kept cool by means of water the clinker is much more easily removed, and

the air spaces between the bars are always found to be quite clear when the clinker is removed. Patents have been obtained for automatically opening doors to admit air over the fire after fresh coal has been thrown on, and closing the openings when the fire has turned bright. Of all these methods there are one or two which we believe have been successfully introduced, and which consume smoke to a considerable extent, and with economy. A much greater economy might be effected if a mechanical stoker could be adopted which would deliver the fuel into the furnace without admitting cold air, and spread the coal evenly over the grate surface from three to six inches in thickness, keeping the air space between the bars quite free, and discharging the clinkers off the bars as they are made, insuring a complete combustion of the fuel.

In discussing this question we sometimes meet with engineers who condemn all mechanical firing, and who say nothing will be able to compete with good hand firing. In reply to this we may say that during the last few years several mechanical stokers have been tested against good hand firing, and the results have been in favour of the former, both in economy of fuel and labour, and also the more speedy generation of steam. It is likewise found that greater reliance can be placed upon a good machine constructed for the purpose than upon hand firing.

For the last forty years engineers and inventors have endeavoured to find a perfect method of mechanical firing for steam generating purposes. To Mr. John Jukes, of Lewisham, credit is due for several very important inventions, and for conducting valuable experiments to accomplish this object.

The machine he patented in 1848 is the stoker with very little improvements, which is called by his name, and is still doing good work in the country. The machines he patented previous to 1848 and since, may have been more correct in theory and ingenuity of mechanism, although, perhaps, less simple and durable. It would scarcely be saying too much to state that the success in London and other manufacturing towns in abating in some degree the smoke nuisance is in great measure due to this machine; for if others have attained the same end in different ways, it was probably the results he obtained which led to their simple and improved inventions. The machine is so well known that a very brief description will serve. The apparatus is erected on a large iron frame mounted on four wheels, which generally run on rails laid as a tramway of its own length under the boiler and immediately in front thereof, so that the machine can be moved bodily away from underneath the boiler when required. On the top of the framework are fixed horizontally at each end cogged rollers, which carry a metal apron composed of a series of small cast-iron bars connected together by pins through holes so as to allow the bars to bend like a chain. When the ends of the bars pass over the cogged rollers they are joined together, and the rollers drawn apart to tighten the bars, form an endless apron. Sufficient length is allowed for the bars to come several feet before the boiler, on which is fixed a hopper into which the coal is thrown. A slide door is arranged so that a greater or less thickness of fuel can be admitted into the furnace. Motion is given to the cogged rollers, which carries the endless apron and fuel into the furnace at a very slow speed. By this means the fuel is carried forward into and consumed in the furnace; the clinker and unburned ash being carried under a bridge wall and deposited in a chamber beneath the bars. This machine is too bulky to allow of its being fixed within the flues of Lancashire boilers.

Although there are some who have arranged their plant so as to be suitable for

the application of these stokers, the majority of manufacturers would be obliged to entirely re-arrange their boilers to apply this description of stoker, and at places where the water used is liable to form heavy incrustation, to place the furnace under the bottom of the boiler might be a fatal objection.

Mr. Townsend, of Glasgow, being a great admirer of this stoker, and wishful to remedy its defects, patented a method to feed the fuel on the opposite end of the apron, down a tube through the boiler, so as to deliver the fuel immediately over the bridge wall, the apron working the reverse way. Although by this means such a stoker may possibly work as economically as any other invented, it is not to be expected that many steam users would go to the expense required to gain this end.

The next class of stokers, and which have been increasing in number for the last twenty years, are those which provide mechanical methods of throwing regularly the fuel over the grate surface by systems of fans, cams, and revolving discs, without any accompanying method of removing the clinker from the bars. One patented by Mr. Dillwyn Smith and improved by Mr. Henderson, manufactured by the Mechanical Stoker Company, Liverpool, has been put on boilers now working in the manufacturing districts. The construction of this stoker is with a hopper fixed over the furnace in front of the boilers; through the bottom of the hopper a spiral worm is placed to carry the fuel opposite the centre of the furnace, under which revolves at great speed a disc or fan which receives the fuel from the worm, throwing it in a shower into the furnace. The fire-doors remain in their usual place to be used for clinkering the fire and assisting the machine if necessary.

Another stoker of more recent date, is that patented by Mr. James Proctor, of Burnley, the hopper and arrangement of the fire-door and bars being like those of the one we have last mentioned. Under the hopper are spiked rollers working within the coal chamber for crushing the coal small enough to pass through on to the inclined flap, preparatory to its being thrown into the furnace; under the crushing roller is a plunge shaft, with a lateral motion, for feeding the small coal to inclined shoots leading to each furnace. The flap is secured to a cross shaft which receives a partial turn or rocking motion from a lever and cam, in a direction away from the fire, until it reaches the right distance, when the spiral spring, released by the tappet, suddenly reverses the shaft and imparts a rapid movement of the flap in the direction of the fire, the coals on the flap being thrown into and over the fire, either at the back end, midway, or at the front. The several throws are effected by means of the tappet having three projections of different lengths. A worm-wheel works the crusher, plunge, and tappets; the flap or double shovel succeeds in spreading the coals over the fire effectually.

There is another stoker we should here notice. The patentee is Mr. Holroyd Smith, of Halifax. He calls the machine the Helix Furnace Feeder. The inventor believes that the theoretically correct way to burn coal is to supply it to the bottom of the fire. To accomplish this in an internally-fired boiler he lays several long tapered tubes in the place and position where a portion of the ordinary bars would be. Between these taper tubes is placed a novel arrangement of bars. These tubes are open on the top side or slotted their whole length after passing the first dead plate. In these tubes are placed auger-like screws of such form and pitch as to have both a propelling and a vertical thrust. The tubes are connected at right angles to a trough with sloping sides placed beneath a hopper. Screws are laid in the sloping trough which carry the coal from the hopper to the tapered tubes. Short shafts from the

end of the screws pass through the end of the tubes on which are small toothed wheels by which motion is imparted to the screw, carrying the fuel down the tubes and up through the slots into the furnace, the green fuel pushing up through the burning mass.

The next three mechanical stokers are the last we shall mention. They are to be classed like the Jukes, as complete mechanical stokers. They have arrangements for both continuously and automatically feeding the fuel into the furnace, and spreading the same over the grate surface in suitable thickness, keeping the air passages between the bars open, and for delivering the clinker as it is made over the ends of the bars. All these machines have been used in mills and manufactories for several years, and subjected to several tests by practical men, who have arrived at some knowledge of their merits. They have respectively become known as the "Todmorden Stoker," the "Vicar's Stoker," and the "McDougall Stoker." The Todmorden Stoker is patented by Messrs Haworth and Horsfall, Engineers, at Messrs. Fielding Brothers, of Todmorden, and is now manufactured by Mr. Ellis Butterworth of Rochdale. The arrangement of this stoker is the use of a hollow water bar, connected in such a manner as to allow the water to circulate through the bars into the boiler. A framework in front of the furnace carries a hopper and gearing for feeding and cleaning. Between the hopper and the front of the boiler is a coking chamber, constructed of fire-bricks. Two sets of bars convey the coal through the coking chamber into the fire on to the tubular bars. The fuel on the bars is carried towards the back by a set of toothed rakes, which come up between the hollow bar and cut into the fuel. The front of the hopper is a moveable one, that can be taken out for banking up and hand firing.

The Vicar's Stoker, patented and manufactured by Thomas and Thomas Vicars, and James Smith, of Liverpool, has been put in use, and it is well known in the manufacturing districts. A substantial framework erected in front of the furnace bears the weight of the hopper and gearing. Coal of any size may be used by the raising or lowering the guide plates, which work on vertical slides at back of hopper, pushing the coal through the aperture into the furnace, where it is received by a series of short fixed bars in lieu of dead plates, previous to its being drawn into the fire by the action of the travelling bars. These moving bars form the most important feature in the design. A cam shaft, running across the front of the furnace, revolves slowly, and moves the bars forward together, carrying with them the fuel *en masse*, but in returning they come back only in groups, thus preventing the fuel being brought back. An intermittent motion is given to the cam shaft. The back ends of the bars traverse a bed plate which, with the cross bearer more to the front, rests on brackets bolted to the sides of the flue.

McDougall's Stoker, patented by McDougall Brothers, of Manchester, and manufactured by the Chatterton Iron Works Company, was only patented in 1874. It is now well known in the manufacturing districts. Like Vicar's Stoker, a self-feeding hopper and self-cleaning bars are its chief features. For a flued boiler fired internally, there is a hopper in front of each furnace: the moving bars are fixed sufficiently forward to come immediately below the hopper, between which an arrangement of ordinary fire doors is placed, so that the furnace can be worked by hand firing should it be required to do so. When the stoker is working the space allowed for hand firing is occupied for coking and igniting the coal as it falls from the hopper on to the moving bars. The bars are actuated by what may be termed an eccentricated shaft of Bessemer steel, the eccentrics are turned on three

different centres, and are alternately arranged, each bar resting on and being worked by its own eccentric or cam. At the bridge the under sides of the bars are bevelled and rest on a similarly bevelled portion of the bridge plate. When the cam shaft revolves, each alternate bar in being lifted by its cam at the front end, is at the same time thrust forward, and running up the incline at the bridge end is also lifted at that point. While this occurs the contiguous bars are depressed by being drawn backwards. The fuel on the bars is by this arrangement carried forward and burnt at a rate dependent on the speed that the cam shaft is driven. The clinker also as it is formed travels from the front to the bridge, on which it is deposited and finally pushed over into the flue, from whence it is withdrawn by the door provided for that purpose.

Various other mechanical stokers have been brought before the public; but we hold the opinion that much has yet to be done before anything like perfection will be arrived at, and mechanical stokers become adopted on a very large scale. There is thus a wide field for our inventors to labour in, the saving of labour, economy in fuel, and purification of the atmosphere being objects right worthy of the best efforts our mechanical engineers can put forth.

W. G.

ON THE PRODUCTIVE POWER AND EFFICIENCY OF MACHINE-TOOLS, AND OF OTHER LABOUR-SAVING APPLIANCES, WORKED BY HYDRAULIC PRESSURE.

By RALPH HART TWEDDELL,
M. Inst. C.E.

At a meeting of the Institute of Civil Engineers, on the 6th of March, the following paper on the above subject was read:—

The author stated that some years ago he had occasion to design a machine, which was required to exert a great pressure in a confined space at a considerable distance from any shafting. The machine had to be portable, and to be capable of doing a large amount of work efficiently without the intervention of skilled labour. Such conditions were of common occurrence, and in this instance all were successfully fulfilled by the employment of hydraulic pressure. The paper was an amplification of the subject of the application of this power to actuating machine-tools, and other labour-saving appliances in engineering works, and was divided under three heads, namely, the introduction and development of hydraulic-pressure machine-tools; the productive power and efficiency of machine-tools generally, and the modes of increasing them; and the increased productive power and efficiency obtainable by the employment of hydraulic-pressure for working machine-tools and other labour-saving appliances. Reference was made to the unpublished experience existing on these questions.

Under the first head an illustration was afforded by a small portable hydraulic apparatus for fixing the ends of boiler-tubes in tube-plates, the pressure of water employed varying from 1 to 1½ ton per square inch. Owing to the introduction of high steam-pressures, the scantlings of marine boilers had to be considerably increased, but the mechanical riveting-machines formerly in use were mostly inadequate to make steam tight joints. In 1865 the author designed a hydraulic riveting-plant to overcome the difficulty. It consisted of pumps, an accumulator, and a riveting-machine, and in operation was seven times more economical than hand-work; moreover, its surplus power was available for hydraulic presses for "setting," or joggling, angle and

tee-irons. In action it was found that the material was much less strained, and that the wear and tear of the moulds and dies was greatly reduced, besides which the machines were movable. Previous attempts to perform similar work by portable machines driven by steam had not been very successful. This, it was believed, was the first hydraulic-pressure riveting-machine which could readily be applied at different points and over considerable areas, and at the same time maintain an uninterrupted connection with the accumulator-pressure in the mains. The system had been extended to machinery of sufficient gap to span the deepest girders, the same hydraulic power which actuated the heavier machines being utilized for lifting them. The water driving these machines and their lifting apparatus was supplied under a pressure of 1,500 lbs. per square inch. Amongst the first to employ them was the firm of Sir William Armstrong and Co. Several instances were then given of their application; for riveting *in situ* the lattice-girder bridge which carried Primrose Street over the Great Eastern Railway at Bishopsgate Street Station; for riveting locomotive boilers; for fastening rivets in gun-carriages and in agricultural machinery; for railway wagon-work, and for riveting ships. The substitution of hydraulic machinery for punching and shearing metals had been more gradual, but it had proved economical and had been employed for shearing the links of chain cables, 3 inches in diameter, both sides at one time. To obtain the full advantages due to the application of hydraulic pressure to machine-tools, the system should be applied throughout the works. This had been first carried out completely at the French naval dockyard at Toulon for building iron and steel war ships. A similar plant had since been erected at the ship-yard of the Forges et Chantiers de la Loire, at Penhouet, near St. Nazaire, illustrations of which were given, as also of another machine at Brest, which was now being constructed from the author's designs. Other applications of hydraulic pressure were then referred to, such as for forging and stamping. The author held that the successful carrying out of hydraulic forging would depend greatly on the skill brought to bear in making the dies and moulds.

As to the productive power and efficiency of machine-tools generally, and the mode of increasing them, the author observed that the cost of manufacturing depended upon the productive power of the tools employed, and upon the possession of facilities for transporting the material to and from them. Ample lifting and transporting arrangements should be provided in all cases. At present a large amount of lifting was done by manual labour, in which there was room for great improvement. Owing to the necessity hitherto of using belting or gearing for working them, power-cranes had only been applied to machine-tools to a limited extent as a means for increasing their output. The author pointed out that by the adoption of portable hydraulic machine-tools a great saving in floor-space might be effected. The introduction of hydraulic capstans had practically annihilated space in docks and railway-yards, and as the haulage of a given weight on a good road required less power than lifting it, an extended application of such machinery to engine-works was to be anticipated. The suitability of this system to increasing the output of large engineering shops and ship-yards was evident, and safety in lifting was ensured in hydraulic cranes by the impossibility of workmen putting on them a greater load than they were calculated to bear.

On the third head, namely, the increased productive power and efficiency obtainable by the employment of hydraulic-pressure for working machine-tools, the author observed that so far as the prime mover was

concerned, the power necessary in a hydraulic system to pump water into the accumulator was nearly always obtained from a steam-engine: but even at this early stage the hydraulic system, by the use of the accumulator, allowed of a considerable reduction in the size of the motor. A comparatively small prime mover running continually, stored up sufficient energy to meet any sudden demand from even the largest of the machines worked from it; while, on the other hand, the prime mover would have to be equal to this. This defect was to a small extent met by the use of fly-wheels, which were, however, objectionable from their liability to accidents, and from the strains to which the shafting was subjected. From 200 to 300 blows per minute had been obtained in hydraulic machines, and in machine-tools and cranes the accumulator acted as a perfect safety-valve. Then, for the transmission of power to points distant from the prime mover, hydraulic pressure was the most economical. By the use of hydraulic mains laid underground, all overhead shafting was dispensed with. Under the present system the lines of shafting, to a great extent, regulated the position of the machines. In a recent case, 48,000 square feet were required with shafting, while 32,000 square feet only were necessary when arranged for hydraulic transmission. In this case the cost of all the roofing and flooring of a building 300 feet long, 53 feet wide, and 25 feet high was saved. A pipe of 1-inch bore could transmit nearly 6·5 h.p. at a very moderate velocity of water, and a 2-inch pipe about 25 h.p. All danger from the use of belts and pulleys was avoided, and when once laid in the ground it needed no further attention.

The next question was as to the suitability of hydraulic pressure to actuating the tools. It had already been employed for slotting and planing-machines, and its application to rotary machines might even become as economical as any other. The simplicity and fewness of parts in all hydraulic machine-tools was a source of great economy. In respect to the economical application of force through each individual machine when performing such an operation as punching, the machine was moving at its lowest speed, and friction was at a minimum when most work was being done. Again, hydraulic machines consumed no power except when actually doing work, while it was not unusual in a machine shop to see all the shafting running in order to drive a small tool at its extremity. With hydraulic machines it was immaterial whether the machine was 2 feet or 2,000 feet from the accumulator, only the exact quantity of water necessary to perform the operation was consumed. In conclusion, the author stated that apart from questions of economy attention might be directed to several of the advantages arising from the application of hydraulic power to special cases. In riveting-machinery it rendered it possible in one and the same machine to close the plates with a steady pressure, to fill the rivet-hole without forcing the metal of the rivets in between the plates, and to give the metal a sharp blow; not only could the heaviest machine be lifted, but the machines could be attached to their work. In punching and shearing machinery much greater accuracy was ensured from the perfect control of the moving punch or knife, whose descent could be arrested even after it had touched the plate. Steel plates were less injured when punched by steady hydraulic pressure. Hydraulic punching and shearing-machines required no foundations, and could be readily taken on board ship, thus saving much carrying to and fro of plates. It was often desirable to follow up the effects of a sharp blow by maintaining a continued steady pressure. This was illustrated by the author, who described an "impact" ac-

cumulator, and pointed out the difference of effect of a number of light blows as compared with one heavy one in the case of hydraulic riveting. Similar conditions applied to forging. The indirect advantages due to the uniformity of all the work applied also to the flanging-machinery, and in fact to everything passing through dies and blocks. He thought that even small firms might find it advantageous to combine in the erection of a common pumping-station, and so to obtain many of the economical benefits due to carrying out operations on a large scale.

STAMPING AND WELDING UNDER THE STEAM HAMMER.

By ALEXANDER McDONNELL, M. Inst. C.E.

THE following paper was read at a meeting of the Institute of Civil Engineers, on March 6th:—

It was observed that the making of iron forgings under the steam-hammer in moulds or dies of simple form had long been practised. They had commonly been of scrap or fagotted iron, were often roughly finished, and much heavier than necessary, requiring too much to be taken off by planing or shaping to finish them. Very few forgings had been produced of a complicated shape, or built up of several pieces, under the hammer, when common bar-iron was used. The steam-hammer had always been employed for welding in completing the rings of wagon-wheels, and in stamping wheels according to the system of Mr. Arbel. So far as the author was aware, little had been done to make smaller forgings, welding together several pieces. He thought sufficient care had not been taken in the drawing office to design forgings so that they could be stamped, and that proper precautions had not been observed by the manager of the works or the foreman-smith, to arrange the material, so that the welds should be made in the right way, the metal flowing in the right direction to fill the mould, and the grain of the iron placed so as to get the greatest strength. Stamping in moulds gave a uniformity and accuracy which afforded great advantages where large numbers of similar objects were made. The author had carried out the system of stamping and welding carriage and wagon iron-work for some years at the Inchicore Works of the Great Southern and Western Railway of Ireland. He contrasted the cost of stamped forgings as compared with forgings by hand, showing that for the more complicated forms, the former process was the cheaper. Although for some purposes the steam-hammer was necessary, he believed many forgings would be better made by hydraulic forging-presses. Finally, he explained the method of making stamped forgings, by giving a detailed account of the manner of forging a number of different articles, which had been selected as fair samples of forgings of carriage and wagon iron-work.

TELEPHONES.

By Sir FREDERICK BRAMWELL, F.R.S., V.P. Inst. C.E.

THE second of a series of six lectures on the Applications of Electricity was delivered on Thursday evening, the 1st of March, at the Institution of Civil Engineers. The following is an abstract of the lecture:—

Prior to the invention of the telephone, by making and breaking circuit at the transmitting station sounds had been produced at the receiving station—such as the striking of bells, or the vibration of a Morse Sounder—but these were independent of sound at the transmitting station, and they varied according to the implement used at the

receiving station, and were and are used for purposes of audible telegraphy. Also, prior to the invention of the telephone, it was possible to reproduce at the receiving station, say by a tuning-fork, the vibrations of which break and make contact, the same note produced by a similar tuning-fork at the transmitting station; and in this case there was a reproduction at the receiving station of the sound at the transmitting station. But the only thing that was ensured was the repetition of the same note—there was no reproduction of the same sound. For example, the note might have been uttered by a violin-string, by a tuning-fork, or by a clarinet at the transmitting station; at the receiving station, however, nothing would be given forth but the note of the particular tuning-fork, or other vibrating implement, which was in accord with the number of the vibrations transmitted in a given time. All these notes were due to the variations of the current caused by break and make in the circuit, and were therefore abrupt. The best result obtained with such an agency was in the machine of Reiss, who, in 1862, reproduced tones, and it is said some words were heard. That machine received no development, and telephony lay dormant for fourteen years, until the invention of Professor Graham Bell, patented in this country in December, 1876. In 1874 Mr. William Henry Barlow, F.R.S., Past-President Inst. C.E., turned his attention to the recording of the vibrations produced by speech. He effected this by means of an instrument called a Logograph. This was communicated to the Royal Society, and exhibited in operation there. By its agency there was depicted on a travelling band of paper the motions derived from the vibration of a membrane under the influence of speech; but had the results been known, they would probably have deterred an inventor seeking to produce a telephone, as it appeared the vibrations were not always the same for the same syllable, but varied with the speaker and from the circumstances. Professor Graham Bell graphically represented the variations in the electric current, either direct or reversed, caused by break and make, and showed that these were too abrupt for his purpose—namely, the reproduction of articulate speech. He proposed to attain the object sought by having the circuit always closed, and by causing rises and falls, or reversals, as the case might be, of electricity which should be made gradually, instead of abruptly, as before. The simplest mode in which he attained this end was in one of the original forms of the Bell Transmitter or receiver (for the instrument was capable of fulfilling either function) by placing an iron or a steel plate in the neighbourhood of a permanent magnet surrounded by a coil of insulated wire, so that on the plate being set into vibration by the voice it should induce, in the coil, reversed currents of electricity which could travel along the wire in prolongation of the coil to the coil of the similar instrument at the receiving station, thereby varying the power of the magnet at that station and setting up vibrations in the corresponding iron disk. This disk, acting upon the air, gave to it vibrations similar to those which had put the first disk into motion, and in that way a reproduction of the original sound (as Professor Bell said a *fac simile*) was obtained. Other modes were employed by him, such as the use of a battery in the line-wire, and best of all, the use of two local batteries to send the current to a primary coil round a core, the line-wire being connected with secondary coils acting by induced electricity. As transmitters these instruments were necessarily somewhat feeble, since the whole of the electricity in the first of the three cases mentioned, and what might be called the operative electricity in the other two cases, had to be derived from the microscopic movements of

the disk, under the influence of the sound-waves produced by the speaker.

Edison's Phonograph was exhibited, in order to show that a disk, when caused to vibrate under speech, could by a central needle impress those vibrations on tin foil, and that on the tin foil being caused to traverse under the needle, the reproduction on the disk of those vibrations caused it to repeat the speech which had originally set the disk into motion. This was appealed to as a convincing proof that a disk, when mechanically vibrated in a manner corresponding to the vibrations which had been imparted to it by speech, was sufficient, wholly irrespective of any electrical agency, to impress upon the air the needful vibrations to reproduce speech.

Edison then devised a transmitter, wherein the disk need not be metallic, but might be mica, and its vibrations were caused to operate upon a small block of carbon, which carbon was introduced in the circuit of a battery. It was thus found that the almost inappreciable variation in pressure due to the vibration of the disk was sufficient, for some not very well understood reason, to alter the conducting power of the carbon, and to cause varying currents to be transmitted along the line-wire to the Bell Receiver at the opposite end. At the present day the universal transmitting instrument for commercial purposes is the carbon transmitter of Edison or some modification thereof.

Professor Hughes' Microphone was next alluded to, and it was stated how by its means the most minute sounds were rendered audible, and how, from the delicacy of the instrument, it was applicable to many scientific purposes.

Edison's Chalk Receiver was subsequently explained. Prior to Edison's time, it had been known that the friction of certain surfaces varied with the electric current passing through them, notably under such circumstances, the friction of the human tissue. Among other appropriate substances prepared chalk was one, and it was shown how Edison availed himself of this. By attaching a stem to the centre of the disk, and pressing this stem by means of an adjustable pressure upon the periphery of a chalk cylinder, a current of electricity passed from the centre of the cylinder through the stem. Upon the cylinder being turned by hand the friction on the stem caused it to move the centre of the disk—its edge being fixed—to a definite position depending on the friction, and on the rigidity of the disk; but, on a variation in the current, the change produced thereby in the friction caused the stem either to be drawn in further or to yield to the elasticity of the disk and to allow it to be moved backwards. In this manner vibrations were set up in the disk corresponding with the vibrations of the transmitter that had sent the varying electrical currents. As in the case of this receiver the power was derived, not from the electricity, but from the hand of the operator turning the chalk cylinder, very considerable loudness was obtained, so that the utterances of the receiver were audible in a large room.

Mr. Shelford Bidwell having been good enough to lend a Photophone, that beautiful invention of Professor Graham Bell was explained. Mr. Bidwell showed how, by speaking to a disk, the front being a mirror, on which a powerful light was directed, that light could be reflected on to a selenium cell, and as the disk vibrated under the influence of the voice the light playing on the selenium cell varied. Selenium was a material the conductivity of which changed with the amount of light upon it. It was therefore possible in this manner to cause a Bell Receiver to speak, and reproduce the speech which had been uttered to the mirror disk. It was pointed out that, in this manner, there was no need of a wire connection between

the transmitter and the receiver, the passage of a beam of light being all that was required.

Reference was then made to the various purposes to which the Telephone might be put, and to the Exchange System and the necessary apparatus for receiving the calls and making the connections between the different subscribers to the Exchange. Amongst special uses, a very interesting one was shown—that of the application of telephony to the diver's helmet. Thanks to the kindness of the captain of the H.M.S. "Vernon" and of Mr. Gorman, a helmet with the whole of the apparatus was exhibited. It was shown how the application of the telephone in no way introduced any complication, as the single wire needed was in the middle of the old call-ropes, the return being made by the water itself. Thus, if the telephone went wrong, the diver was left without additional apparatus of any kind to encumber him, and yet with all the resources that he would have had in the absence of the telephone.

It was stated that the development of the Telephone had been far more rapid in America than in England. As an instance it was mentioned that in the City of Washington, with a population of about 120,000 white persons, as many as 800 telephones were used. Then a return circulated that very day by the United Telephone Company, was read, showing that on the 28th of February, in the year 1881, there were, independent of private lines, 845 subscribers to the London Exchange; that on the same day in 1882 the number had increased to 1,505—or an addition of 660; and on the 28th of February this year, the number was 2,541, or an addition of 1,036; and that contemporaneously with these increases, the use of the Telephone by each Subscriber had augmented, until it now reached more than 7½ calls per day for each Subscriber, which—at a cost of £20 a year, represented only two pence a call; or, bearing in mind that each call involved a return message, it only amounted to one penny for the message sent each way.

The Lecturer was fortunate in having the assistance of Mr. E. H. Johnson, who had been so much associated with Mr. Edison in carrying out many of his inventions, and who was kind enough to put into work both the Phonograph and the Chalk Receiver.

An improved water lac varnish for finishing wall paper and for similar purposes has been patented by Mr. George H. Beck, of New York city. The composition consists of the following ingredients, combined in about the proportions stated, viz.: Ammonia, 140 grms.; shellac, 97.15 grms.; water, 5000 grms.; gelatin, 132 grms.; glycerin, 60 grms. When the varnish is ready for use, it may be applied by rollers or by a grounding machine, and will give the paper an even, rich, and waterproof leather finish, furnishing a surface that may be washed with warm or cold water.

Packing butter.—An invention, the object of which is to provide a new and improved vessel for packing butter in such a manner that it will remain fresh and sweet, and will be protected from the action of the air, has been patented by Messrs. John J. Carey and Patrick Cavanaugh, of La Salle, Ill. The invention consists in a jar provided with an inner and outer cover, resting on packing rings, and held on the jar by means of clamps, passed over a circular ridge on the outer cover. The clamps are provided in their lower hooks with rubber blocks, resting with their upper edges against the lower edge of an external collar of the jar, which collar is provided with beveled recesses. By moving these clamps out of the recesses and along the edge of the collar, the outer cover will be held and pressed on the jar and its packing rings.

The Scientific Review

AND

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ANTONIO BRADY, till his decease, 1881.

SESSION 1882—1883.

April 26th. A Paper on "Steam and Water Valves," by
T. MORGAN, Esq., A.S.E.

Subscriptions are payable to Mr. G. A. STRETTON, the Re-
ceiver, 4, St. Martin's-place, S.W., who is the proper official to
give receipts.

DEATH OF MR. F. W. CAMPIN.

It is with extreme regret that we have to record the death
of Mr. F. W. CAMPIN, F.R.S.L., Barrister at Law, &c.,
for many years the well known and respected Secretary
of the Inventors' Institute, which took place at his re-
sidence, Talfourd Lodge, Camberwell, on Sunday evening,
the 1st of April.

He had been long and incessantly occupied in dealing
with matters connected with the reform and amendment of
our Patent Law system, and in fact up to the day of his
decease he was busily engaged in the furtherance of move-
ments for the benefit of Inventors, by whom his loss will
be much deplored.

The melancholy tidings only reaching us just as we go
to press, we are precluded from giving that notice in the
present issue which should be accorded to one so inti-
mately connected with the interests of this Journal and of
the Inventors' Institute. We have, therefore merely to
conclude this brief report by drawing the attention of our
readers to the fact that the last ideas of Mr. CAMPIN on
the subject of the Patent Laws will be found in the article
on the Government Patent Bill, at present before the
House of Commons, the proofs of which article were re-
vised and corrected by him only the day before his death.

Monthly Notices.

Lectures at the Royal Institution.—Prof. J. G. M'Kendrick, ten
lectures on Physiological Discovery; Dr. Waldstein, four lectures
on the Art of Phidias; Prof. Tyndall, three lectures on Count
Rumford, originator of the Royal Institution; Mr. R. S. Poole,
three lectures on Recent Discoveries in (1) Egypt, (2) Chaldaea and
Assyria, (3) Cyprus and Asia Minor; Mr. A. Geikie, six lectures on
Geographical Evolution; and Prof. C. E. Turner, four lectures on
Historical Sketches of Russian Social Life. The discourses on the
Friday evenings will probably be given by Mr. A. Geikie, Dr.
Waldstein, Prof. B. Balfour, Mr. C. W. Siemens, Mr. R. A. Scott,
and Profs. Huxley, Turner, Flower, Pollock, and Dewar.

Iron and Steel Institute.—On Monday, March 12, it was resolved,
at a private meeting in the Middlesborough Exchange, to invite
the Iron and Steel Institute to hold their next annual meeting at
Middlesborough, where the Institute originated in 1869.

Telephone Battery.—Mr. James Moser announced to the Aca-
démie des Sciences on February 12th that he had constructed a
battery of telephones by which he can give to the current any
desired strength.

The Ventilators on the Embankment.—At a preliminary meeting
of workmen and others held at Anderton's Hotel, Fleet Street,
for the purpose of making arrangements for the holding of a public
meeting in Exeter Hall, to protest against the attempt now being
made by the Metropolitan Board of Works to close the ventilators
on the Thames Embankment, Mr. S. Plimsoll, late M.P. for Derby,
stated that an average of 93,418 persons travelled over the District
Railway daily during last year, and he opined that there was not
an average daily attendance of persons in the Embankment gar-
dens of more than 60 or 70. In the outcry which had been raised
against the ventilators he noticed an utter absence of all reference
to the comfort of the passengers using the railway. He used the
railway himself, and could testify that during the last two or three
years the atmosphere was unbearable; and now that the company
were going to spend £20,000 with the simple object of increasing
the comfort of the passengers on their line, he thought that those
passengers should be considered and the company should have
their support. Until they got a better means of ventilating the
railway he thought it would be simply absurd to close the existing
ventilators, which had been placed in their present positions after
a careful inquiry by a committee of the House of Commons. It
would be strange if the House of Commons reversed the decision
of one of its committees; and especially so if it were in such inde-
cent haste as to suspend its standing orders for this purpose. At
the suggestion of Mr. Passmore Edwards, M.P., it was resolved
that a deputation should seek an interview with the Prime Minister,
for the purpose of personally explaining to him the views of the
working classes and others using the railway as to the desirableness
of retaining the ventilating shafts. [We very much regret that Mr.
Edwards, who has been for years connected with scientific litera-
ture, should lend himself to such pseudo working man's arguments.
The ventilation could be effected in a much better way than by
making the Thames and its banks into a nuisance district.—ED. S.R.]

An Artistic Novelty.—Messrs. Wyman and Sons have issued with
the *Printing Times* and *Lithographer* a photo-filigrane portrait of
Senefelder, the inventor of lithography. At first sight the paper
containing the portrait appears to be blank, but on holding it to
the light the likeness is seen in a form which suggests the familiar
water mark. It is explained that the portrait is taken from a very
old lithographic print, and that, therefore, it is an inadequate
specimen of what can be done by a new process perfected by Messrs.
Brown, Barnes, and Bell, of Liverpool. Watermarks are produced
by designs in wire work, which are comparatively crude. "Fili-
grane" is the name given in France to linear paper, and paper
with a checkered pattern. In photo-filigrane the result is pro-
duced by pressure between hard rollers, one of which is embossed
by photographic means. The cost is small compared with water
marking, and half tone and gradations are secured. The effects
are produced by those parts of the photographically engraved
design which are in relief, compressing the paper sufficiently to
render the part so compressed more transparent to transmitted
light and darker in colour by reflected light. Among many sug-
gested applications are wall papers, visiting cards, and book illus-
tration by means of surface blocks to supersede wood engraving.

THE SCIENTIFIC REVIEW

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APRIL, 1883.

THE PATENT BILLS.

To muddle and confuse seem to be the kind of work at which the Governments of the present day are very handy; hence the placing together in one Bill to amend and *consolidate* the Law relating to Patents for Inventions, Trade Marks, and Registration of Designs, is by no means subject for wonder, though the three things are very different in character, and require different treatment. As, however, spurious unification is the form and manner in which the Government Bill is brought before the House of Commons, we must deal with it as it stands, merely remarking that the main question we have to deal with is the Patent Law. There are two other Bills before the Legislature which we have already brought under notice in our columns, viz: the Society of Arts, or No. 2 Bill, and No. 3 Bill, by Messrs. ANDERSON, BROADHURST, and others, as to which we have fully informed our readers. The Government Bill is endorsed by Mr. CHAMBERLAIN, the SOLICITOR-GENERAL, and Mr. JOHN HOLMS, and the following particulars collated from the Memorandum and Bill itself are worthy of attention:—

The law regulating applications for and the grant of Patents is 30 years old, dating from 1852; and there are some half dozen other Statutes relating to Patents, passed between 1835 and 1859. The principal Acts which provide for the registration of ornamental and useful designs, and for conferring copyright therein, are 40 years old, having been passed in 1842 and 1843; and there are amending Acts of 1850, 1858, 1861, and 1875. Some of the above Statutes contain provisions which have become obsolete or unnecessary, and are confused in arrangement and form.

The Trade Marks Act is comparatively modern, having been passed in 1875; but it contains some unworkable provisions relating to the Cutlers' Company, and the definition of a trade mark also requires amendment. The Trade Mark Acts of 1876 and 1877 are short amending Acts.

In 1865 and 1870 two Acts were passed for the protection of unpatented inventions and unregistered designs from the consequences of user or publication at or during the holding of industrial or international exhibitions.

The Bill proposes to consolidate and repeal these Acts also.

As regards the provisions of the three divisions of the Bill relating respectively to Patents, Designs, and Trade Marks, the principal alterations in the present systems are as follow:—

I.—PATENTS.

The fees payable at present in order to obtain a Patent amount to £25, with further payments of £50 before the expiration of the third year and £100 before the expiration of the seventh year of the Patent. Under the Bill a Patent will be obtainable for £4, for the United Kingdom, Channel Islands, and Isle of Man, and while the amount of the further payments remains unaltered, the payment of the £50 is postponed to the fourth year; so that a four years' Patent will only cost £4.

Under the existing Acts it is necessary for an intending patentee or his agent to apply personally at the Patent Office at

least seven times, and make four separate payments, using four documents for the application.

By this Bill an applicant or his agent will only have to call twice at the Patent Office, to use three documents, and to make two payments; but applicants may, if they please, transact their business entirely by post, and thus avoid either personal attendance at the Office or the payment of agency fees.

The proceedings under Bill will therefore comprise:—

1. Entry of provisional documents in Register.
2. Provisional documents being referred to Examiner at Patent Office. Cl. 6.
3. Notification of acceptance to Applicant or Agent by post.
4. Complete Specification placed before Examiner. Cl. 19. 1.
5. Advertisement of acceptance of Complete Specification. Cl. 10.
6. Notification of acceptance of Complete Specification sent to Applicant or Agent by post.
7. Patent prepared and sealed. Cl. 12.
8. Patent sent to Applicant or Agent by post.

It is also proposed to sell the new application and specification forms ready stamped at the Patent Office, or to send them by post at the price of the fee, *i.e.*, no charge to be made for the blank form itself. Only two stamped forms (the Provisional Specification when used not being stamped) will be necessary, one a £1 declaration form, and another a £3 form, for the complete specification. The Inland Revenue Department will also arrange to sell these stamps at Post Offices in the principal commercial centres of the kingdom. At present persons residing in the country must either employ an agent in London to obtain the stamped forms, or obtain them through a stamp office from the Inland Revenue Department by post.

The Bill provides for enforcing the grant of compulsory licenses in certain cases, and subject to proper safeguards. Cl. 22.

It is proposed to lay down principles for the guidance of the Court which has jurisdiction to extend the term of a patent. Cl. 25 (4).

In any action for infringement, either party will be empowered under the Bill to require a skilled assessor to be called in, Cl. 27; and in any such action a patentee will be able by leave of the Court to disclaim, and give his disclaimer in evidence, but not in such case to obtain damages without leave of the Court. Cl. 19. 20.

The proceeding by *scire facias* to repeal a patent is abolished, and power to obtain revocation on petition to the Court substituted. Cl. 26.

The following are the other principal new provisions:—

1. Limitation of patent to one invention made statutory; with a proviso that it shall not be competent in an action or other proceeding to object to a patent on the ground that it comprises more than one invention. Cl. 31.
2. Extension of provisional protection from six to fifteen months, or from application to sealing of patent. Cl. 14.
3. Extension of first term of a patent from three to four years. Cl. 17 (2). The duration of patents will continue to be 14 years.
4. The Provisional Specification and the Specification to contain distinct statement of claims. This will be of very great service for the purposes of indexing and reference. Cl. 5.

5. Deposit of complete specification before the grant of the patent.

This must be made within *nine months* from date of application with a provisional specification for patent. Cl. 8.

6. Appointment of examiners—

(a) To examine applications for the purpose of seeing that the invention is subject matter for a patent, and that its nature has been fairly described. Cl. 6.

(b) To compare complete with provisional specifications for the purpose of seeing that they correspond. Cl. 19.

(c) To examine amendments and disclaimers. Cl. 18.

7. Appeal to law officer from examiners. Cl. 5, 9, 18.

8. Substitution of Seal of Patent Office for wafer seal now used in lieu of the Great Seal. Cl. 12.

9. Enlargement of time for payment of fees and renewal. Cl. 17 (3), (4).

10. Publication of an illustrated journal of patented inventions. Cl. 37.

11. Discontinuance of register of proprietors;—copies of deeds, &c., hitherto copied therein to be supplied by the parties interested at their own cost.

12. Discontinuance of sending to Edinburgh and Dublin transcripts of letters patent and deeds and certified copies of specifications and disclaimers, but printed copies of the Patent Office publications will be sent to these cities.

13. Transfer of Patent Museum to Department of Science and Art, with power to require models on payment. Cl. 38, 39.

14. The provisions of the separate Acts relating to the protection of unpatented inventions exhibited at industrial and international exhibitions are repealed and re-enacted in the Bill. Cl. 36.

II.—DESIGNS.

1. At present there is a twofold classification of designs into ornamental and useful, and they are registered under separate Acts, which, however, in their main features are the same. It is often difficult to determine to which class a design belongs, while a so-called useful design might frequently be the subject of a Patent, were it not for the cost. Inasmuch as under the Bill the first fee on Letters Patent is to be reduced from £25 to £4, (£10 being now charged for the registration of a useful design), it is proposed to discontinue the distinction between ornamental and useful designs, and to accept for registration *any* novel design in the proper sense of the word. Such "useful" designs as embrace a mechanical action would be treated as subject-matter for a Patent. 2. Additional facilities are provided for the registration of designs, provisional registration being abolished, and complete registration provided for without the necessity of depositing actual specimens of the design on application; but such specimens must be deposited before sale and delivery of goods to which the design is applied. Cl. 44—47.

3. It is proposed to make uniform the various existing terms of copyright by the adoption of a fixed term of four years for all designs. Cl. 47. 4. Power is taken to establish an office at Manchester for the deposit of specimens of designs for cotton prints, &c. Cl. 54. 5. The provisions of the separate Acts relating to the protection of unregistered designs exhibited at industrial and international exhibitions are repealed and re-enacted in the Bill. Cl. 53. 6. The existing power to register works of sculpture is omitted as unnecessary.

III.—TRADE MARKS.

1. The present definition of a Trade Mark has been extended to include—

(a) Fancy words not in common use; (b) Brands; and (c) Single letters as old Trade Marks. Cl. 60.

2. Power is taken to clear the list of applications for Trade Marks of those applications which have not been proceeded with during a reasonable period. Cl. 59. 3. Provision is made for giving notice by advertisement of applications for registration, and for opposition to registration. Cl. 63, 64. These are now regulated by rules. 4. No alteration will be made in the term for which a trade mark is registered, namely, 14 years, with renewal; but the provisions for this purpose, now made by rules, are inserted in the Bill. Cl. 72. 5. The provisions of the existing Act regarding the registration of Sheffield (Cutlers' Company) marks have been amended, so as to bring the method of registering marks at Sheffield into harmony with the system of registration in London. Cl. 74.

GENERAL.

1. All proceedings relating to the grant of Patents, and registration of designs and trade marks, will be under control of an officer, called the comptroller, acting under the superintendence of Board of Trade. Cl. 76. 2. Power is taken to provide a new Patent Office. Cl. 75. 3. Power is taken to join the International Union for the reciprocal protection of Patents, Designs, and Trade Marks. Cl. 92.

THE BILL.

Clause 1. This Act may be cited as the Patents, Designs, and Trade Marks Act, 1883. Cl. 2. This Act is divided into parts, as follows:—Part I.—Preliminary. Part II.—Patents. Part III.—Designs. Part IV.—Trade Marks. Part V.—General. Cl. 3. This Act, except where it is otherwise expressed, shall commence from and immediately after the *thirty-first day of December one thousand eight hundred and eighty-three*.

After such an explicit, though general, statement of the nature of the Bill, it will be unnecessary to publish any clauses in detail which are not peculiar or important; however, the *first* of these refers to the Provisional Specification, and obliges an applicant for a Patent to set forth in such document a distinct statement of claim,—a manifest *absurdity*, because the utility of Provisional Protection is to enable an inventor to secure himself whilst his invention is still in its *incomplete* or *provisional* state, at which time only security is required to enable the inventor to experiment and test his invention in safety; and until he is satisfied as to its being in a complete state, he is not in a position to state his claims with exactness. It is very curious that most people seem determined not to see what is the difference between a *provisional* and a *complete* specification. The Crown Law Officers, who now deal with these documents, often require them to state all particulars as fully in the first of them as is demanded by law in the second. If this demand for claims be not altered or considerably modified, the Bill will confer no boon on the working man and the poor inventors.

Cl. 5. (1.) An application for a Patent must be made in the form set forth in the First Schedule to this Act; and must be left at, or sent by post to, the Patent Office in the prescribed manner.

(2.) An application must contain a declaration to the effect that the applicant is in possession of an invention, whereof he claims to be the true and first inventor, and for which he desires to obtain a Patent; and must be accompanied by either a provisional or complete specification.

(3.) A *provisional specification* must describe the nature of the invention, and be accompanied by drawings, if required.

(4.) A *complete specification*, whether left on application, or subsequently, must par-

ticularly describe and ascertain the nature of the invention, and in what manner it is to be performed, and must be accompanied by drawings, if required.

(5.) A specification, whether *provisional* or *complete*, must commence with the title, and end with a *distinct statement of the invention claimed*.

Cl. 6. The comptroller shall refer every application to an examiner, who shall ascertain and report to the comptroller whether—

(a.) The invention is subject matter for a Patent; and

(b.) The nature of the invention has been fairly described, and the application, specification, and drawings (if any) have been prepared in the prescribed manner.

Cl. 7. (1.) If the examiner reports that the invention is *not subject matter for a Patent*, the comptroller may refuse the application.

(2.) If the examiner reports that the nature of the invention is not fairly described, or that the application specification or drawings has not or have not been prepared in the prescribed manner, the comptroller may require that the application specification or drawings be amended before he proceeds with the application.

(3.) Where the comptroller so refuses an application or requires an amendment, the applicant may appeal from his decision to the law officer.

(4.) The law officer shall, if required, hear the applicant and the comptroller, and may make an order determining whether and subject to what conditions, if any, the application shall be accepted.

(5.) The comptroller shall, when an application has been accepted, give notice thereof to the applicant.

The question referred to in the above clauses has become an *experimentum crucis*, because the law proclivities of judges have nearly succeeded in diverting the current that was some years ago running in favour of the subject matter for a Patent being based simply on a new product, or a better or cheaper production of material things without regard to the *small* mechanical or chemical change effected; whereas the more recent law cases are in opposition thereto, as stated in that unpretentious and very reliable book in Weale's Series, by F. W. Campin (Barrister-at-Law), "The Law of Patents for Inventions" (p. 13), where in citing *Penn v. Bibby* (2 L. R. Eq., Chap. 136), it is asserted that what, though "out of the track of former use," if it would naturally suggest itself without "thought and study," cannot support a Patent at law. A legal dictum which, if applied by those who grant Patents, will be very liable to engender ridiculous freaks of fancy prejudice and puerility being frequently perpetrated. The *application*, on the face of it, being found to contain a statement of an invention, should receive provisional protection at once, any other plan is objectionable and despotic; for although grace and favour of the crown is the law as to Patents, nobody believes in such law.

Cl. 8. (1.) If the applicant does not leave a complete specification with his application, he may leave it at any subsequent time within *nine months* from the date of application.

(2.) Unless a complete specification is left within that time the application shall be deemed to be abandoned.

Cl. 9. (1.) Where a complete specification is left after a provisional specification, the comptroller shall refer both specifications to an examiner for the purpose of ascertaining whether the complete specification has been prepared in the prescribed manner, and whether the claims in the two specifications are substantially the same.

(2.) If the examiner reports that the claims in the two specifications are not substantially the same, the comptroller may re-

fuse to accept the complete specification; but any such refusal shall be subject to appeal to the law officer.

(3.) The law officer shall, if required, hear the applicant and the comptroller, and may make an order determining whether and subject to what conditions, if any, the complete specification shall be accepted.

(4.) Unless a complete specification is accepted within *twelve months* from the date of application, then (save in the case of an appeal having been lodged against the refusal to accept) the application shall, at the expiration of those *twelve months*, become void.

Cl. 10. On the acceptance of the complete specification the comptroller shall advertise the acceptance; and the application and specification or specifications with the drawings (if any) shall be open to public inspection.

Cl. 11. (1.) Any person may at any time within *two months* from the first advertisement of the acceptance of a complete specification give notice at the Patent Office of opposition to the grant of the Patent.

(2.) Where such notice is given the comptroller shall give notice of the opposition to the applicant, and shall, on the expiration of those *two months*, refer the case to the law officer.

(3.) The law officer shall, if required, hear the applicant and any person so giving notice and being, in the opinion of the law officer, entitled to be heard in opposition to the grant, and shall determine whether the grant ought or ought not to be made.

(4.) The law officer may, if he thinks fit, obtain the assistance of an expert, who shall be paid such remuneration as the law officer, with the consent of the Treasury, shall appoint.

Cl. 12. (1.) if there is no opposition, or, in case of opposition, if the determination is in favour of the grant of a Patent, the comptroller shall cause a Patent to be sealed with the seal of the Patent Office.

(2.) A Patent so sealed shall have the same effect as if it were sealed with the Great Seal of the United Kingdom.

(3.) A Patent shall be sealed as soon as may be, and not after the expiration of *fifteen months* from the date of application, except in the cases herein-after mentioned, that is to say—

(a.) Where the sealing is delayed by an appeal to the law officer, or by opposition to the grant of the Patent, the Patent may be sealed at such time as the law officer may direct.

(b.) If the person making the application dies before the expiration of the *fifteen months* aforesaid, the Patent may be granted to his legal representative and sealed at any time within *six months* after the death of the applicant.

Cl. 13. Every Patent shall be dated and sealed as of the day of the application: Provided that no proceedings shall be taken in respect of an infringement committed before the publication of the complete specification.

Cl. 17. (1.) The term limited in every Patent for the duration thereof shall be *fourteen years* from its date.

(2.) But every Patent shall, notwithstanding anything therein or in this Act, cease at the end of the *fourth* or the *seventh* year of its term, unless in the *fourth* and in the *seventh* year respectively of its term the patentee takes out at the Patent Office a certificate of renewal, which shall be granted on his request in writing.

(3.) If, nevertheless, in any case, by accident, mistake, or inadvertence, the patentee fails so to take out a certificate of renewal, he may apply to the comptroller for an enlargement of the time for taking it out.

(4.) Thereupon the comptroller may, if he thinks fit, on receipt of the prescribed fee for enlargement, not exceeding *ten pounds*,

enlarge the time accordingly, subject to the following conditions:—

(a.) The time for taking out such a certificate shall not in any case be so enlarged as to extend beyond *six months* from the end of the *fourth* or the *seventh* year as aforesaid (as the case may be).

(b.) No proceeding shall be taken in respect of an infringement of the Patent committed within the enlarged time, unless by leave of the Court before which the proceeding is proposed to be taken.

AMENDMENT OF SPECIFICATION.

Cl. 18. (1.) An applicant or a patentee may, by request in writing left at the Patent Office, seek leave to amend his specification by way of disclaimer or explanation, stating his reasons for the same.

(2.) The request shall be advertised in the prescribed manner, and at any time within *three weeks* from its first advertisement, any person may give notice at the Patent Office of opposition to the amendment.

(3.) Where such notice is given the comptroller shall give notice of the opposition to the person making the request, and shall refer the case to the law officer.

(4.) The law officer shall, if required, hear the person making the request and the person so giving notice, and being in the opinion of the law officer entitled to be heard in opposition to the request, and shall determine whether, and subject to what conditions, if any, the amendment ought to be allowed.

(5.) Where no notice of opposition is given, or the person so giving notice does not appear, the comptroller shall determine whether, and subject to what conditions, if any, the amendment ought to be allowed.

(6.) When leave to amend is refused by the comptroller, the person making the request may appeal from his decision to the law officer.

(7.) The law officer shall, if required, hear the person making the request and the comptroller, and may make an order determining whether, and subject to what conditions, if any, the amendment ought to be allowed.

(8.) No amendment shall be allowed that would make the specification, as amended, claim an invention substantially larger than or substantially different from the invention claimed by the specification as it stood before amendment.

(9.) Leave to amend shall be conclusive as to the right of the party to make the amendment allowed, except in case of fraud; and the amendment shall in all courts, and for all purposes, be deemed to form part of the specification.

(10.) The foregoing provisions of this section do not apply when, and so long as any action for infringement or other legal proceeding in relation to a Patent, is pending.

Cl. 19. (1.) In an action for infringement of a Patent, and in a proceeding for revocation of a Patent, the Court or a judge may order that the patentee shall, subject to such terms as to costs and otherwise as the Court or a judge may impose, be allowed to disclaim any part of the invention specified in such order, and give the disclaimer in evidence.

(2.) Where a patentee so disclaims he shall, within the prescribed time, leave at the Patent Office a copy of the order giving him leave to disclaim, and of his disclaimer.

Cl. 20. Where an amendment by way of disclaimer has been allowed under this Act, no damages shall be given in any action in respect of the use of the invention before the disclaimer, unless the patentee establishes to the satisfaction of the Court that his original claim was framed in good faith and with reasonable skill and knowledge.

Cl. 21. Every amendment of a specification shall be advertised in the prescribed manner.

Cl. 25. Extension of term of Patent on petition to Queen in Council.

REVOCATION BY PETITION TO COURT.

Cl. 26. (1.) The proceeding by scire facias to repeal a Patent is hereby abolished.

(2.) Revocation of a Patent may be obtained on petition to the Court.

(3.) Every ground on which a Patent might, at the commencement of this Act, be repealed by scire facias shall be a ground of revocation.

(4.) The plaintiff must deliver with his petition particulars of the objections on which he means to rely, and no evidence shall, except by leave of the Court or a judge, be admitted in proof of any objection of which particulars are not so delivered.

(5.) Particulars delivered may be from time to time amended by leave of the Court or a judge.

(6.) The defendant shall be entitled to begin, and give evidence in support of the Patent, and if the plaintiff gives evidence impeaching the validity of the Patent, the defendant shall be entitled to reply.

LEGAL PROCEEDINGS.

Cl. 27. Hearing with assessor.

Cl. 28. Delivery of particulars of breaches and by defendant. Delivery of particulars of objections to the Patent.

Cl. 29. Order for inspection, &c., in action, may be obtained.

Cl. 30. In an action for infringement of a Patent, the Court or a judge may certify that the validity of the Patent came in question; and if the Court or a judge so certifies, then in any subsequent action for infringement, the plaintiff in that action on obtaining a final order or judgment in his favour shall have his full costs, charges, and expenses as between solicitor and client, unless the Court or judge trying the action certifies that he ought not to have the same.

Cl. 40. (1.) A Patent shall not prevent the use of an invention for the purposes of the navigation of a foreign vessel within the jurisdiction of any of Her Majesty's Courts in the United Kingdom, Channel Islands, or Isle of Man, or the use of an invention in a foreign vessel within that jurisdiction, provided it is not used therein for, or in connection with, the manufacture or preparation of anything intended to be sold in, or exported from, the United Kingdom, Channel Islands, or Isle of Man.

(2.) But this section shall not extend to vessels of any foreign state in whose territories British subjects do not enjoy equal benefits in respect of the subject matter of this section.

Cl. 41. Assignment to Secretary for War of certain inventions. This is similar to present Act.

FEES ON INSTRUMENTS FOR OBTAINING PATENTS, AND RENEWAL.

(a.) Up to sealing.

	£	s.	d.	£	s.	d.
On application for provisional protection ..	1	0	0			
On filing complete specification ..	3	0	0			

or

On filing complete specification with first application ..	4	0	0			
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(b.) Further before end of four years from date of Patent.

On certificate of renewal ..	50	0	0			
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(c.) Further before end of seven years from date of Patent.

On certificate of renewal ..	100	0	0			
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PRESERVATION OF MEAT.—M. Pavesi proposes to preserve meat by treatment with *aqua regia*, which he applies also to anatomical preparations. The proportions to be used are not stated.—*Cosmos Les Mondes*.

Proceedings of Societies.

ROYAL SOCIETY.

FEB. 8.—The President in the chair.—The following paper was read, "Note on Terrestrial Radiation," by Dr. Tyndall.

ASTRONOMICAL SOCIETY.

FEB. 9.—Annual General Meeting.—Prof. E. J. Stone, President, in the chair.—Messrs. A. W. Daughlish and G. W. H. Maclear and the Rev. E. T. Shaw were elected Fellows.—The President announced the death of Prof. H. J. Smith, one of the vice-presidents of the Society, and suggested that Sir G. B. Airy should be elected in his place. Amongst the Fellows and Associates of the Society who have died during the past year are Mr. Plantamour, Prof. Zöllner, Dr. Robinson, of Armagh, Mr. C. V. Walker, and Mr. C. E. Burton. Eleven minor planets have been discovered during the year. The total number of minor planets now discovered amounts to 231.—The Report of the Council contains notices on the micrometrical measurements made on Harvard Observatory, on Mr. Darwin's work on small displacements of the plumb-line, on Mr. Burnham's double-star observations, on Dr. Schubar's determination of the mass of Jupiter, on Oppolzer's syzygy tables, on Dr. Dreyer's determination of the constant of precession, on Prof. Peter's zodiacal charts, and on Prof. Holden's monograph on the nebula of Orion.—The President, in presenting the gold medal of the Society to Dr. Gould for his "Uranometria Argentina," remarked that the work may be considered as an extension of Argelander's scale of magnitudes to all stars which can be seen by a good eye without instrumental aid between 10° north declination and the South Pole. The catalogue is accompanied by a series of stars on the stereographic projection, giving the position of stars down to the sixth magnitude. Some idea of the work undertaken by Dr. Gould may be derived from the fact that the number of estimates of brightness exceeded 46,000.—The following gentlemen were elected as Officers and Council for the coming year:—President, E. J. Stone; Vice-Presidents, Dr. J. C. Adams, Sir G. B. Airy, W. H. M. Christie, and J. R. Hind; Treasurer, F. Barrow; Secretaries, J. W. L. Glaisher and E. B. Knobel; Foreign Secretary, Dr. W. Huggins; Council, Capt. W. de W. Abney, J. Campbell, J. R. Capron, Dr. A. Cayley, A. A. Common, G. H. Darwin, Dr. Warren De La Rue, A. M. W. Downing, E. Dunkin, G. Knott, Rev. C. Pritchard, and A. C. Ranyard.

GEOLOGICAL SOCIETY.

FEB. 7.—Mr. J. W. Hulke, President, in the chair.—Dr. G. D'Arcy Adams, Prof. F. M. Krause, and the Rev. A. W. Rowe were elected Fellows, and Dr. Karl A. Zittel, of Munich, a Foreign Correspondent of the Society.—The following communications were read: "On the Metamorphic and Overlying Rocks in parts of Ross and Inverness Shires," by Dr. H. Hicks, with petrological notes by Prof. T. G. Bonney,—and "On the Lower Carboniferous Rocks in the Forest of Dean, as represented in Typical Sections at Drybrook," by Mr. E. Wethered, with an appendix by Dr. T. Wright.

SOCIETY OF ANTIQUARIES.

FEB. 14.—Mr. A. W. Franks, V.P., in the chair.—The Hon. J. B. L. Warren was admitted a Fellow.—Dr. C. S. Percival communicated notes on six very beautiful matrices of mediæval seals, exhibited by Mr. J. Evans. They were as follows:—1. Seal of the Rural Dean of Bicester; date, fifteenth century. 2. Seal of the Guild of St. Mary of Cambridge. This guild, together with

that of Corpus Christi in the same town, brought about the foundation of Corpus Christi College, circa 1356; date, fourteenth century. 3. Seal of Richard de Terring, clerk; date, fourteenth century. 4. Seal of John Russell, Clerk; date, early thirteenth century. 5. Personal seal, without name; date, fifteenth century. 6. Common seal of an unascertained Italian monastery of St. Stephen.—Mr. E. Freshfield communicated an elaborate account (profusely illustrated by four large plans and photographs) of the town of Calais, and of the vestiges, now fast disappearing, of ancient remains, and of traces of English rule.

BRITISH ARCHÆOLOGICAL ASSOCIATION.

FEB. 7.—Mr. T. Morgan in the chair.—Further discoveries at the Roman Castrum, South Shields, were reported by Mr. R. Blair.—The efforts made to preserve the old Tol House, Great Yarmouth, were detailed by Mr. F. D. Palmer in a communication which stated that the Mayor and Corporation had agreed to sell the building for a nominal sum to trustees, to be devoted to some useful purpose.—Mr. L. Brock, in reading the above, referred to the great antiquarian interest of the building, which is known to have belonged to the Corporation as early as 1251. The assurance of the safety of the building was received with much applause.—The Chairman congratulated the town on having thus arranged to preserve so interesting an object, and Mr. G. R. Wright referred to the visit paid to it during the Yarmouth congress.—Mr. W. de Gray Birch spoke of the readiness with which the building could be adapted for a museum.—Mr. Gardner exhibited some Parthian coins which had been used as amulets, on one of which Dr. Phené pointed out the emblem of a star above the crescent moon, and traced the continuance of the latter in the present Turkish standard.—Mrs. Arthur Cope exhibited a large series of silver plate of the Cromwellian period in illustration of one of the papers.—Mr. C. H. Compton exhibited a silver consular denarius, showing the earliest form of the lituus.—The first paper was read by Mr. G. Lambert "On Richard Cromwell." The antecedents of the family and the death of Oliver having been rapidly traced, many interesting historical events were passed in review, as were also the cabals and factions which preceded the retirement of Richard from the Government. The paper concluded with notices of the later years of his life and of his burial at Hursley. A collection of coins of the Protectorate was exhibited by the lecturer.—The second paper was "On the Traders' Signs in Old St. Paul's Churchyard," by Mr. H. Syer Cuming. After referring to the referring to the rise of the custom of denoting shops by signs, the animated appearance which the streets of a town must have presented in mediæval times was referred to. St. Paul's Churchyard having been always a place of considerable commerce, the number of trading signs must have been very great. Many hundreds were referred to, of very different import, such as, for example, the Three Kings, Tobit's Dog, the Trinity, the Serpent and Dragon, kings, saints, angels, flowers, birds, and a motley group of things animate and inanimate.

LINNEAN SOCIETY.

FEB. 1.—Sir J. Lubbock, Bart., President, in the chair.—Messrs. F. W. Burbridge and J. Johnson were elected Fellows.—Dr. W. C. Ondaatje called attention to examples of red coral from Ceylon.—Mr. W. T. Thiselton Dyer exhibited a model of the fruit of the double cocoa-nut (*Lodoicea seychellarum*, Lab.) of an unusual form, obtained from Major-General C. G. Gordon.—A series of microscopic sections of coal plants were shown on behalf of Mr. J. Norman.—The

following paper was read: "On the Structure, Development, and Life-history of a Tropical Epiphyllous Lichen," by Mr. H. M. Ward. The author's observations lead him to believe that the Epiphyllous cryptogam in question supports the view that a lichen is a compound organism composed of an alga on which an ascomycetous fungus has become more or less intimately affixed and dependent. It is developed on the leaves of many plants, but it has been more closely watched on *Michelia fureata*. The lichen presents four types—orange-red stellate patches, greyish-green blotches, clear grey spots, and white shining circles; but these pass imperceptibly into one another and vary in size from a speck to a quarter of an inch in diameter. The reddish spots of the earlier stages is an alga of which the radiating filaments are in part productive organs and in part barren hairs. It subsequently passes into the grey and green stages, and by a modification of growth the invasion of a fungus mycelium succeeds. The white matrix of the complete lichen consists of the same algal thallus invested by dense masses of the fungus hyphae, which produce shining black dots, viz., the fruit bodies. The author describes in detail the peculiarities of growth and reproduction of the alga and fungus and the formation of the lichen. He alludes to and criticises Dr. Cunningham's account of *Mycoides parasitica*, which plant is evidently closely related to that described by himself. Assuming that *Mycoides* and Ward's alga are generically the same, either Cunningham discovered a female organ of reproduction which becomes fertilised and produces zoospores, or he confounded this with fertile hair organs. As regards the systematic position of the alga, a comparison with *Colaeoete* suggests that there is very little in common beyond the mode of growth of the disc-like thallus and the production of zoospores from certain cells. The genus *Chroolepus*, moreover, presents features which agree in several important points, viz., orange-red oily cell contents, habitat, and production of zoospores in ovoid cells developed terminally and laterally. The structure of the thallus and the relative positions of the main masses of fungal and algal portions agree with what occurs in heteromorous crustaceous lichens, as Graphidea, but the perithecia indicate its angiocarpous alliance, bringing the form nearer such families as Pertusaria and Verrucaria, to the latter of which it may ultimately be referred.—A paper was also read by Mr. F. M. Campbell "On the Pairing of *Tegenaria guyonii* and Description of Certain Organs in the Male Abdominal Sexual Region." Two cases are related in which, during confinement, the males killed the females after union, and an instance is also given of an attempt to impregnate an immature female which was also destroyed by the male. In these cases hunger could not have been the cause of the attack. The writer explains the occurrences, and also the accounts of females destroying males after union, on the ground that those instincts which are habitually practised throughout the far greater portion of the life of the species, and on which it is dependent, would scarcely be suspended for a longer period than necessary for the sexual union. Some of the habits of spiders, and especially of this species, are mentioned as bearing on these sexual conflicts, and the specific benefits that would arise from them are referred to. The paper is concluded by a note on some glands (probably of spinning function) situated on the convexity of the abdominal sexual region. The ducts are considerably convoluted, and open through transparent tubular spines, which are arranged transversely to the axis of the body of the spider. Two papilla-like processes below the opening of the genital sinus are described.

ZOOLOGICAL SOCIETY.

FEB. 6.—Prof. W. H. Flower, President, in the chair.—The Secretary read a report on the additions to the menagerie during January, and called attention to examples of two species of passerine birds from Japan (*Turdus cardis* and *Parus varius*) new to the collection.—Letters and papers were read: from Mr. F. C. Selous, dated from the Matabele country, on the possibility of obtaining a white rhinoceros,—from the Rev. G. H. R. Fisk, of Cape Town, on the habits of some reptiles which he had had in captivity,—from Messrs. Salvin and Godman, on a new species of pigeon of the genus *Otidiphas* from Ferguson Island, one of the D'Entrecasteaux group, which they proposed to call *O. insularis*,—by Mr. Selater, on *Tragelaphus gratus*, and on drawings of both sexes of this antelope, taken from specimens living in the menagerie of the Jardin des Plantes, Paris,—from Mr. E. W. White, supplementary to a former paper on the birds of the Argentine Republic,—from the Rev. G. A. Shaw, on the habits of an aye-aye which he had had in confinement for several months, and other information respecting this animal,—and by G. A. Boulenger, on a new species of lizard of the genus *Eryalis* from Peru, which he proposed to name *E. palpebralis*.

THE INSTITUTION OF CIVIL ENGINEERS.

FEB. 13.—Mr. Brunlees, President, in the chair.—The paper read was "On the Design and Construction of Repairing Slipways for Ships," by Mr. T. B. Lightfoot and Mr. J. Thompson.

MATHEMATICAL SOCIETY.

FEB. 8.—Prof. Henrici, President, in the chair.—Capt. P. A. Macmahon was admitted into the Society.—The following communications were made: "On the Sylvester-Kempe Quadruplane," by Mr. H. Hart.—"On Curves obtained by an Extension of Maclaurie's Method of constructing Conics," by Mr. S. Roberts.—"A Generalization of the 'Nine-points' Properties of a Triangle," by Capt. Macmahon.—"On the Use of certain Differential Operators in the Theory of Equations," by Mr. J. Hammond,—and "A Method for reducing the Differential Expression $dt/(t-a, t-\beta, t-\gamma, t-\delta)$ to the Standard Form," by Mr. J. Griffiths.

NEW SHAKSPEARE SOCIETY.

FEB. 9.—Mr. F. J. Furnival in the chair.—Miss G. Latham read a paper "On the Witches in Shakspeare." Dwelling first on the extent and variety of superstitious beliefs held by an Elizabethan audience, Miss Latham proceeded to contrast the characters of the witches in "Macbeth" with Middleton's treatment of the same subject, showing that Middleton, with his multitude of details, made us lose all idea of the supernatural. His incantation scene is crammed with Latin words, while Shakspeare's is remarkable for its simplicity. Shakspeare's witches are never allowed to hide the central figure; the human interest is preserved throughout, the witches being kept in the background. In the "Tempest," Sycorax, having imprisoned Ariel in a pine, could not undo her own work; a curious instance of a similar nature is given in Spalding's "Miscellany."—On the question of the priority of Middleton's "Witch" to "Macbeth," Dr. B. Nicholson said that he had come across a passage in Middleton where he alludes to "knights in business;" this helped to fix a date, and to strengthen Malone's already conclusive arguments that Middleton wrote his play before "Macbeth."

ARISTOTELIAN SOCIETY.

FEB. 5.—Mr. S. H. Hodgson, President, in the chair.—Prof. W. James, of Harvard University, was elected a Corresponding Member.—The discussion of Kant's "Critique of Pure Reason," was resumed by Mr. E. B. Bax.

SHORTHAND SOCIETY.

FEB. 7.—Mr. C. Walford, President, in the chair.—The following new Members were elected: Messrs. G. Walpole, T. Hill, W. Mullins, B. Cooper, W. E. Bailey, G. Fitzgibbon, J. Stacey, H. Stacey, W. G. Coupe, W. Hodge, W. E. Wright, A. H. Browne, J. Fretwell (Chicago), and A. Lelioux (Paris).—Mr. Pocknell exhibited two printed copies of a Prayer Book in shorthand, dated 1730, in the style of J. Weston.—Mr. T. Hall exhibited a new type-writer of his own invention, and explained the same.—Mr. A. James, author of "Standard Stenography" (an improvement on Taylor's system), read a paper in explanation of his system, and a discussion followed in which Messrs. Anderson, T. Cooper, Guest, Fretwell (Chicago), and others took part.—A paper by M. Guénin on the Tyronian notes was deferred till the next meeting.—Mr. T. Anderson, author of "History of Shorthand," was appointed Hon. Foreign Secretary in the room of Mr. H. Richter, resigned.

DRAINAGE AND VENTILATION OF HOUSES.

At a recent meeting of the Society of Medical Officers of Health, London, a paper was read by Mr. Rogers Field, M.I.C.E., on "Certain Less Recognised, but Highly Important, Points in the Drainage and Ventilation of Houses," of which the following is an abstract:—

Three sanitary principles govern house drainage. These are:—

1. All refuse matter must be completely and rapidly removed from the house.
2. There must never be any passage of air from the drains or waste pipes into the house.
3. There must be no connection between the drains and the domestic water supply.

These, although so simple, are very frequently neglected. The first goes absolutely to the root of sanitation; for were it strictly complied with, there would be no leaky drains, no polluted subsoil, and no production of foul gases in the drains from decomposing organic matter. There cannot be a greater mistake than to assume, as is commonly done in investigating drainage, that if water runs away with freedom this is all that is required. Numerous cases are on record where the sewage from houses has apparently run away freely for years, but where the greater portion of it has really been leaking out of the drains into the ground under or close to the house. In illustration of this point, the author quoted two cases in his own practice: one in which the connection with the sewer was actually found to be blocked with shavings, which had been left in when the house was built three years before; the other that of a school in which the drainage from the laboratories had leaked through disused drains under the floor of a large portion of the building, and where, although there was a mass of filth in some places seven feet deep, no leakage had been suspected. If the drains are exposed, and found clean and jointed with cement, this is not sufficient; the tops of the joints may be good and the bottoms bad. The only safe method is to actually test the drains by plugging them at the lower end and filling them with water. Very few house drains, indeed, stand this test.

Even if the drains are outside the house, it is a mistake to assume that it is unimportant whether they are sound, for not only

may sewage leak out of faulty joints and percolate under the house, but foul air may be drawn into the house. It is important to realise how small an amount of deposit will create mischief by decomposing and generating foul gases; a mere irregularity of the joints, even when the drain has a good fall, is sufficient to cause this. There is no better test of the condition of the drains than the amount of smell emitted from a ventilating opening, for, if drains be properly laid, and in thorough working order, practically no smell should exist. Examples were given. Faulty forms of traps and water-closet apparatus were strongly condemned by the author, and diagrams descriptive of good and bad closets were exhibited.

The principle that there should never be any passage of air from the drains or waste pipes into the house was then considered, and the means of isolating the house drains from the public sewer, the necessity of keeping the drains outside the house, their ventilation, as well as that of the soil-pipes, the position of the water closets, the disconnection of the sanitary fittings inside the house from the drains, were referred to. It was insisted that the danger should be guarded against of trusting too much to those parts of the drainage of a house which are visible, as an index of the condition of other and important parts which are concealed; and an instance was mentioned of a house, the drainage of which had been reconstructed, and where all the sanitary arrangements appeared at first sight to be perfect, but where a subsequent examination of the drains which were under the house showed that the joints were in many places defective, and at one point the pipes were not jointed at all, but a space left large enough to put a hand in, though it was stated that special care had been taken to make the drains water-tight. Old drains, which had no outlet connected with gullies, were found beneath the passages and rooms; the housemaid nearly died of typhoid fever, and beneath the room she occupied was found an old drain, with a large amount of foul deposit. A long list of other defects was described, leading to the conclusion that the drainage, instead of being very good, was really so radically defective throughout that it was necessary to reconstruct the whole of it.

Another instance was given in which a lady and her cook were attacked with erysipelas and blood poisoning shortly after occupying a house. Various alterations were made in the drainage in the absence of the family, but, on their return, the lady was again attacked with erysipelas, and shortly after other members of the household. Again alterations were made, and again the lady was attacked with erysipelas, and the housemaid with typhoid fever. An examination of the house by the author showed that an old stoneware drain in the scullery, into which the sink formerly discharged before it was disconnected, had not been removed, and though stopped with cement, the stopping was imperfect, thus allowing the air of the drain to enter the house. The author next considered the various ways in which foul air from faulty drainage inside the house passes to different parts, and pointed out the opportunities which were given for the passage of air from one part of a house to another, depending chiefly upon windows and fires, the latter, of course, mainly acting by drawing air through passages, staircases, and doors. But other channels must also be borne in mind, and an interesting account was given of the passage of foul air along bell wire tubes, the proximity of the bell-pull to the fireplace giving an increased opportunity for air to be drawn from a distance to this part of the room. Channels for gas pipes and for hot water pipes also not uncommonly give facility for the admission

of foul air. In connection with this part of the subject a remarkable instance was given of a particular bed in a school, the occupants of which were constantly the subjects of slight attacks of pneumonia with tendency to typhoid. In this case the foul air was conducted from a lavatory, where there was defective drainage, up a staircase, and, impinging on the ceiling of the dormitory, was reflected on the bed where the sickness occurred.

An interesting account is given of the cause of the Duchess of Connaught's recent illness. Defective drainage was found in the basement of the house, and after numerous experiments the means by which the foul air entered the Duchess's bedroom was discovered. These showed that it was only when occupying certain positions in the room that she would be exposed to the influence of the foul air, while in bed she would escape. As a matter of fact, in twenty-four hours after sitting on a sofa in one of these exposed positions, her Royal Highness's symptoms fully developed themselves. These two cases were illustrated by diagrams. The necessity of a thorough disconnection between the drains and the domestic water supply was then dwelt upon, and the mistakes most commonly made in this particular pointed out.

INTERIOR OF THE EARTH.

WE still find it confidently assumed in geological text-books that the centre of the earth is in a molten or liquid condition; and there are yet amongst us hundreds of geologists, of the older school, who tenaciously adhere to this theory, and to whom it is yet painful to be told that such a supposition is no longer tenable. According to this older view, the earth is a hollow shell, of from one to two hundred miles thick, within which the remainder of the substances forming the globe are still in a molten state, and heated to a very high degree.

The chief facts which led to this conclusion may be stated as follows:—The temperature of the earth steadily increases, in all parts of the world, as we descend below the surface towards the centre.

In mines and other excavations in the earth we find that for the first ninety feet, or thereabouts, the temperature varies with the climate and seasons, but below this thickness, which is termed the *zone of variable temperature*, the heat is found to be the same all the year round, and it then increases about one degree Fahrenheit for every sixty feet of descent. Local conditions, of course, vary this rate of progress somewhat, but it is nevertheless about the average.

Perhaps the most convincing argument in favour of the central fire theory has been that derived from the existence of volcanoes and geysers, which are distributed over many parts of the world; and likewise the similarity of the materials ejected by volcanoes wherever they are in operation; thus indicating, as has been supposed, a common reservoir for all of them.

The modern theory is, as most of our readers know, that the earth is more or less a solid structure throughout, but that here and there, within short distances from the surface, material in a heated condition, from various causes, exists in cavities formed by the unequal contractions of the whole structure.

Recent research has conclusively shown that the centres of force from which earthquakes originate, are situated but a very few miles beneath the surface; and Bunsen and others have demonstrated that the shafts of those Geysers which have been experimented with may best have their depth expressed in feet.

These two facts alone would seem enough to shew the non-necessity of a liquid centre to account for volcanoes and geysers; but there are far graver reasons which bring us

to the conclusion that such a condition of the globe is an impossibility at the present time.

If a circle of about two inches diameter be drawn with a rather thick line for the circumference, we shall have some approximation to the proportions of the earth, having a crust or shell about one hundred miles thick. If we now suppose such shell to have the rigidity of steel, it is clear that the tidal action of the moon would operate upon a liquid interior in such a manner that the surface would heave and swell in tidal waves, following the moon's motion round the earth, and with a crust of less tenacity the internal liquids would certainly burst forth with disruptive violence under the enormous pull exercised upon every particle of the earth by both the moon and the sun. Besides which, it is perfectly clear that under the enormous pressures necessarily existing at the depth of even a hundred miles, substances would retain the solid form at very high temperatures indeed. It is therefore far more rational to suppose that the generation of the heat necessary for volcanic action is comparatively near the surface, and we think that the same is chiefly due to two causes. First, from chemical action produced by the percolation or influx of water upon a deposit of sulphur or other compound in manner similar to that of water action on sulphuric acid. And secondly, by the pressure becoming converted into heat, in consequence of contraction of the whole mass, resulting from the secular cooling of the earth.

We have here a theory which meets the known facts, for there are numbers of volcanoes near the sea, large lakes, or other convenient sources of water supply; and we have at the same time a key to the gradual dying out of both volcanoes and geysers. It is also easy to see the likelihood of long extinct volcanoes becoming again active from a new subterranean vent being opened by earthquake action or otherwise. And finally, we have by this means a complete explanation of the special localisation of these wondrous phenomena, which form probably the most awe inspiring spectacles to be found in nature. W. G.

RECENT AMERICAN AND FOREIGN PATENTS.

An improved *wagon seat spring*, the object of which is to provide strong, light, cheap, and elastic springs for carts and wagons, has been patented by Mr. Montillion H. Cassidy, of Wakefield, Va. The invention consists of a narrow strip of steel, the ends of which are curved over in the form of a C, to which extremities is attached the seat. The straight portion of the spring is provided with pendent legs for use in attaching it to the wagon body.

Churn.—Mr. John J. Kimball, of Naperville, Ill., has patented an improved churn. The invention consists in a box, through the diagonally opposite corners of which passes a bar or axle ending in a crank, and to which is attached internally two circular blades at right angles to one another, which are rotated by means of the crank without. A breaker is placed in the corner of the churn, which greatly facilitates the process.

An improved *coffee urn* has been patented by Messrs. Louis F. Duparquet and Pierre Hont, of New York city. The object of the invention is to facilitate the removal of the receiver for the decoction from the water tank of a coffee urn. For this purpose the receiver is provided with a flange adapted to rest on the rim of the water pot, which is provided with an inwardly projecting flange that rests upon the flange of the decoction receiver.

An improved *fabric* for boots and shoes, which is at once warm and easy for the feet, preventing the drawing action of rubber, has been patented by Mr. Henry E. Urann, of Providence, R.I. A sheet of cork is first

affixed to canvas or other material suitable for backing, and in turn cemented or otherwise secured to the material of which the boot or shoe is made. The fabric is not only employed for the upper or leg part of the boot, but likewise for the sole.

An improvement in *lanterns* whereby is obviated the necessity of soldering the lantern to the bottom of the light chamber has been patented by Mr. William Porter, jr., of New York city. The invention consists in securing the bottom of the light chamber to the bottom of the lantern by means of a three-ply flange, which more firmly secures the parts together than when solder is employed, and at the same time forms a three-ply stiff internal flange, better adapted to support the springs of the lamp than the two-ply flange ordinarily employed.

An improvement in *saw filers* has been patented by Mr. Harvey P. Jones, of Winterset, Ia. The invention consists of devices in combination with a clamp for holding the saw and a frame for carrying the file to gauge the depth, pitch, and inclination of the teeth; and it also consists of a contrivance of the file frame, whereby the file is made to run with a rising and falling guide, on which its frame rides from end to end of the range of the file, so that the curved edge of the file acts uniformly on the saw the whole length of the file.

A compound for *coating the inside of vessels* which are intended to contain butter, lard, oils, beer, wines, liquors, or mineral waters, which is insoluble by any of these liquids, and at the same time impermeable to fluids, has been patented by Mr. Edgar G. Frisbie, of Monroe, Mich. It consists of the following ingredients: For every gallon of this compound is used shellac, one pound; beeswax boiled in alcohol, one-half pound; whiting in alcohol, one-fourth pound; and alcohol sufficient to make up the gallon. The mixture may be applied to the vessel on the inside like any paint or liquid by means of a brush.

A novel *oil pail*, designed to provide a new and improved receptacle for oil, which can be filled easily, and from which the oil can be drawn readily, has been patented by Mr. John W. Collier, of Lockport, N.Y. The pail, one portion of which is left flat, so that it may be hung against the wall, has an opening in the top to facilitate the filling the pail, which opening is provided with a stopper, and a strainer, to prevent dirt from entering the pail. It is also provided with a tube and vent valves, connected with the faucet for admitting of air while drawing or filling. The pail is coated on the inside with a solution of glue to prevent the oil from entering the wood.

An improved *sign* consisting of a frame with a transparent plate set in it, with letter colour or gilt on its inner face, and a filling applied on its front face to form margins for letters, has been patented by Mr. Frank E. Munn, of Dallas, Texas. Instead of employing a simple strip of glass for the groundwork of all the letters, separate pieces are employed for each letter, so that in case one piece should be broken it will not be necessary to insert glass for all the letters of the sign, but simply for the broken or defaced ones.

A device called a *sand band*, for preventing sand, dust, and water from passing into the space between the axle and the axle box in a hub, has been patented by Mr. John Schoellkopf, of Tididoute, Pa. The invention consists in a cup-shaped ring, mounted loosely on the axle between the inner end of the hub and a collar on the axle, which ring is provided with an external shoulder, between which and the collar a spiral spring surrounds the axle, and presses the ring against the hub. The ring is provided with an annular flange having notches through which studs pass, which project from the collar on the axle and prevent the ring from rotating with the hub.

